General

Guideline Title

ACR Appropriateness Criteria® chronic wrist pain.

Bibliographic Source(s)

Rubin DA, Weissman BN, Appel M, Arnold E, Bencardino JT, Fries IB, Hayes CW, Hochman MG, Jacobson JA, Luchs JS, Math KR, Murphey MD, Newman JS, Scharf SC, Small KM, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness CriteriaÂ® chronic wrist pain. [online publication]. Reston (VA): American College of Radiology (ACR); 2012. 13 p. [92 references]

Guideline Status

This is the current release of the guideline.

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Recommendations

Major Recommendations

ACR Appropriateness Criteria®

Clinical Condition: Chronic Wrist Pain

Variant 1: With or without prior injury. Best initial study.

Radiologic Procedure	Rating	Comments	RRL*
X-ray wrist	9		☢
MRI wrist without contrast	1		O
MRI wrist without and with contrast	1		O
MR arthrography wrist	1		O
CT wrist without contrast	1		☢
CT wrist with contrast	1		☢
CT wrist without and with contrast	1		☢

Radiologic Procedure	Rating	Comments	RRL*
CT arthrography wrist	1		☢☢☢
US wrist	1		O
Tc-99m bone scan wrist	1		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 2: Routine radiographs normal or nonspecific. Persistent symptoms. Next study.

Radiologic Procedure	Rating	Comments	RRL*
MRI wrist without contrast	9	Most of the time, further imaging is not required. If imaging is to be performed, this is the study of choice.	O
MR arthrography wrist	4		O
MRI wrist without and with contrast	1		O
CT wrist without contrast	1		☢
CT wrist with contrast	1		☢
CT wrist without and with contrast	1		☢
CT arthrography wrist	1		☢
US wrist	1		O
Tc-99m bone scan wrist	1		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 3: Routine radiographs normal or nonspecific. Suspect inflammatory arthritis. Next study.

Radiologic Procedure	Rating	Comments	RRL*
MRI wrist without and with contrast	9	Further imaging is usually not required for diagnosis, but is often used to stage disease and guide therapy. See statement regarding contrast in text under "Anticipated Exceptions."	O
MRI wrist without contrast	7		O
US wrist	5		O
CT wrist without contrast	3		☢
MR arthrography wrist	1		O
CT wrist with contrast	1		☢
CT wrist without and with contrast	1		☢
CT arthrography wrist	1		☢
Tc-99m bone scan wrist	1		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 4: Radiographs normal or show nonspecific arthritis. Exclude infection. Next study.

Radiologic Procedure	Rating	Comments	RRL*
Aspiration wrist	9	Using imaging guidance if necessary.	Varies
MRI wrist without contrast	1		O
MRI wrist without and with contrast	1		O
MR arthrography wrist	1		O
CT wrist without contrast	1		☢
CT wrist with contrast	1		☢
CT wrist without and with contrast	1		☢
CT arthrography wrist	1		☢
US wrist	1		O
Tc-99m bone scan wrist	1		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 5: Ulnar-sided pain; normal or nonspecific radiographs. Next study.

Radiologic Procedure	Rating	Comments	RRL*
MRI wrist without contrast	9		O
MR arthrography wrist	7		O
CT arthrography wrist	5		☢
MRI wrist without and with contrast	4	See statement regarding contrast in text under "Anticipated Exceptions."	O
X-ray arthrography wrist	3		☢
CT wrist without contrast	1		☢
CT wrist with contrast	1		☢
CT wrist without and with contrast	1		☢
US wrist	1		O
Tc-99m bone scan wrist	1		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 6: Radial-sided pain; normal or nonspecific radiographs. Next study.

Radiologic Procedure	Rating	Comments	RRL*
MRI wrist without contrast	9		O
MR arthrography wrist	6	If scapholunate ligament tear is the primary consideration, MR arthrography is more sensitive than MRI without contrast.	O
CT arthrography wrist	3		☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative**

Radiologic Procedure	Rating	Comments	RRL*
MRI wrist without and with contrast	5	See statement regarding contrast in text under "Anticipated Exceptions."	O
US wrist	5	If extra-articular soft-tissue pathology is the primary consideration, US is helpful.	O
X-ray arthrography wrist	3		☢
CT wrist without contrast	1		☢
CT wrist with contrast	1		☢
CT wrist without and with contrast	1		☢
Tc-99m bone scan wrist	1		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 7: Radiographs normal or nonspecific. Suspect Kienböck's disease. Next study.

Radiologic Procedure	Rating	Comments	RRL*
MRI wrist without contrast	9		O
CT wrist without contrast	5		☢
MRI wrist without and with contrast	3		O
Tc-99m bone scan wrist	2		☢☢☢
MR arthrography wrist	1		O
CT wrist with contrast	1		☢
CT wrist without and with contrast	1		☢
CT arthrography wrist	1		☢
US wrist	1		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 8: Kienböck's disease on radiographs. Next study.

Radiologic Procedure	Rating	Comments	RRL*
CT wrist without contrast	5	Only if needed to assess degree of collapse and associated fractures.	☢
MRI wrist without contrast	4		O
MRI wrist without and with contrast	3		O
CT wrist with contrast	1		☢
CT wrist without and with contrast	1		☢
CT arthrography wrist	1		☢
MR arthrography wrist	1		O
US wrist	1		O
Tc-99m bone scan wrist	1		☢☢☢

Radiologic Procedure	Rating	Comments	*Relative Radiation Level
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 9: Palpable mass or suspected occult ganglion cyst; normal or nonspecific radiographs. Next study.

Radiologic Procedure	Rating	Comments	RRL*
MRI wrist without contrast	8	MRI and US are alternative initial examinations.	O
MRI wrist without and with contrast	8	MRI and US are alternative initial examinations. See statement regarding contrast in text under "Anticipated Exceptions."	O
US wrist	8	MRI and US are alternative initial examinations.	O
MR arthrography wrist	1		O
CT wrist without contrast	1		☢
CT wrist with contrast	1		☢
CT wrist without and with contrast	1		☢
CT arthrography wrist	1		☢
Tc-99m bone scan wrist	1		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 10: Pain for more than 3 weeks. Suspect occult fracture or stress fracture. Radiographs nondiagnostic. Next study.

Radiologic Procedure	Rating	Comments	RRL*
MRI wrist without contrast	9		O
CT wrist without contrast	7	If hook of hamate is suspected, CT is study of choice.	☢
X-ray wrist	2	Additional views (carpal tunnel or semipronational oblique) may be of value if not obtained at time of original study.	☢
MRI wrist without and with contrast	1		O
MR arthrography wrist	1		O
CT wrist with contrast	1		☢
CT wrist without and with contrast	1		☢
CT arthrography wrist	1		☢
US wrist	1		O
Tc-99m bone scan wrist	1		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 11: Radiographs show old scaphoid fracture. Evaluate for nonunion, malunion, osteonecrosis, and/or post-traumatic osteoarthritis. Next study.

Radiologic Procedure	Rating	Comments	RRL*
MRI wrist without contrast	9	MRI and CT are alternative examinations. Only one test needs to be performed.	O
CT wrist without contrast	9	MRI and CT are alternative examinations. Only one test needs to be performed.	☢
MRI wrist without and with contrast	5	See statement regarding contrast in text under "Anticipated Exceptions."	O
MR arthrography wrist	1		O
CT wrist with contrast	1		☢
CT wrist without and with contrast	1		☢
CT arthrography wrist	1		☢
Tc-99m bone scan wrist	1		☢☢☢
US wrist	1		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 12: Suspect carpal tunnel syndrome.

Radiologic Procedure	Rating	Comments	RRL*
X-ray wrist	9		☢
US wrist	3		O
MRI wrist without contrast	3		O
MRI wrist without and with contrast	1		O
MR arthrography wrist	1		O
CT wrist without contrast	1		☢
CT wrist with contrast	1		☢
CT wrist without and with contrast	1		☢
CT arthrography wrist	1		☢
Tc-99m bone scan wrist	1		☢☢☢
X-ray arthrography wrist	1		☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Summary of Literature Review

Introduction/Background

In patients with chronic wrist pain, imaging studies are an important adjunct to history, physical examination, laboratory testing, and electrophysiology studies. The choice of imaging modality depends on the patient's presentation and the clinical questions being asked. There are scenarios where no imaging beyond baseline radiographs is necessary, but in other situations advanced imaging has added value for diagnostic evaluation and treatment planning.

Radiography

Imaging evaluation of the painful wrist should begin with radiographs. This simple, relatively inexpensive study may establish a specific diagnosis in patients with arthritis, complications of injury, infection, some bone or soft-tissue tumors and impaction syndromes, or static wrist instability. The standard radiographic examination consists of posterior-anterior (PA) and lateral views, often supplemented by one or more oblique view. The lateral view is important for demonstrating malalignment and soft-tissue swelling. A variety of stress positions and maneuvers can be performed to elicit dynamic instability that is not visible on standard radiographs. Other nonstandard projections may be indicated for specific suspected problems. Additionally, radiographs are necessary for accurate measurement of ulnar variance.

In the past, fluoroscopic observation was used to establish the diagnosis of dynamic wrist instability, and it had been suggested that it could be cost-effective in lieu of arthrography. However, in most practices fluoroscopy is used either for guidance during wrist injections or as an adjunct to arthrography. Percutaneous aspiration of the wrist – which is indicated in cases of suspected septic arthritis or to assess for intra-articular crystals – can be carried out with either fluoroscopic or ultrasound guidance if imaging is needed.

Scintigraphy

Bone scintigraphy has been used for diagnosing occult wrist fractures and also as a screening procedure in patients with wrist pain and negative radiographs. However, while it is sensitive to bone abnormalities, scintigraphy suffers from a lack of specificity. Furthermore, bone scans cannot detect soft-tissue abnormalities — such as lesions of the ligaments, tendons, and cartilage — which are often responsible for chronic wrist pain.

Arthrography

Although conventional arthrography — performed with contrast injection into one or more wrist compartments — has moderate accuracy for the diagnosis of triangular fibrocartilage (TFCC) and intrinsic ligament perforations, it has largely been supplanted by computed tomography (CT) arthrography and magnetic resonance (MR) arthrography. These cross-sectional studies provide more anatomic detail about internal derangements, which is needed for treatment planning, and they often demonstrate extra-articular abnormalities responsible for pain when there is no ligament or TFCC abnormality. Furthermore, while fibrocartilage and ligament perforations are moderately associated with ulnar-sided wrist pain, there is a poor correlation between ligament lesions and radial-sided pain, further limiting the usefulness of conventional arthrography in this patient population.

Magnetic Resonance Imaging (MRI)

MRI of the wrist accurately depicts abnormalities of the bones and bone marrow, articular cartilage, intrinsic and extrinsic ligaments, TFCC, synovium, tendons, and neurovascular structures, making MRI a powerful study for chronic pain caused by diverse etiologies. Properly performed and interpreted, wrist MRI has a profound clinical impact. In one study, initial clinical diagnosis was changed in about half of the patients with wrist pain after they underwent MRI, and even when the suspected clinical diagnosis was confirmed, diagnostic confidence increased in another quarter of the patients imaged. The same study found that the treatment plan was altered by the results of MRI in approximately half of the wrists.

A dedicated receiver coil or transmit-receive coil is necessary to provide the signal-to-noise ratio (SNR) needed for high-resolution, high-contrast MRI of the wrist. MR arthrography — either with direct contrast injection into one or more wrist compartments or performed indirectly after intravenous contrast administration — can enhance the yield of the study for diagnosing internal wrist derangements, especially abnormalities of the ligaments, articular cartilage, and TFCC of the wrist. MRI performed with a 3.0-T magnet and a dedicated coil provides better SNR and better contrast compared with wrist MRI performed with 1.5-T or lower field strength systems, suggesting that a 3.0-T MRI of the wrist may be a reasonable alternative when MR arthrography is not available.

MRI has been most thoroughly investigated for diagnosing abnormalities of the intrinsic ligaments and TFCC. Accuracy is higher for tears of the scapholunate compared to the lunotriquetral ligament. Performing indirect MR arthrography may increase the sensitivity of the examination of scapholunate ligament tears, but probably not for lunotriquetral ligament tears. Direct MR arthrography (with contrast injection either into the radiocarpal joint or into all three compartments of the wrist) has higher accuracy than noncontrast-enhanced MRI for diagnosis of both scapholunate and lunotriquetral ligament tears, including incomplete tears, and interobserver agreement and diagnostic confidence are also higher with direct MR arthrography. Even when compared to conventional MRI performed with a 3.0-T magnet, direct MR arthrography has higher sensitivity for intrinsic ligament lesions, although there may be more false-positive diagnoses as occasionally contrast will communicate between the radiocarpal and midcarpal compartments in wrists where ligament tears are not visible at MR arthrography or arthroscopy, presumably due to pinpoint-size lesions. For the scapholunate ligament, direct MR arthrography also allows more accurate determination of which specific segments of the ligament are torn compared to conventional MRI, which has important biomechanical implications for wrist stability. Direct MR arthrography also has an advantage over noncontrast-enhanced MRI for diagnosing extrinsic ligament abnormalities.

Both traumatic and degenerative lesions of the TFCC can produce chronic, ulnar-sided wrist pain. MRI is highly accurate for lesions involving the radial (central) zone of the disc, especially with the use of high-resolution fast spin-echo or 3-dimensional (3D) gradient-recalled pulse sequences. There is some evidence suggesting that MRI performed with a 3.0-T system is even more accurate than MRI performed with a 1.5-T system for

TFCC lesions, but there are no studies comparing the accuracy of the two field strengths in the same patients. The sensitivity for tears of the ulnar attachment of the disc and the peripheral attachments (the ulnocarpal ligaments) are only fair with noncontrast-enhanced wrist MRI. Indirect MR arthrography does not improve the accuracy of the examination for diagnosing TFCC lesions, whether peripherally or centrally located. Direct MR arthrography (performed with contrast injection of the radiocarpal or distal radioulnar compartments, alone or in combination) does result in better diagnostic accuracy for the TFCC compared with conventional MRI, especially for ulnar-sided lesions.

Unlike the case for the knee and other larger joints, MRI shows only fair sensitivity for depicting articular cartilage defects in the distal radius and carpal bones, even with the use of indirect MR arthrography or 3.0-T scanners. The presence of focal bone marrow edema may be a clue to underlying chondral defects. A single study found that direct MR arthrography was more sensitive for articular cartilage defects compared to conventional MR, but the same study showed that CT arthrography was even more sensitive.

MRI is highly sensitive to changes in bone marrow composition, and thus is frequently used to identify radiographically occult acute fractures throughout the skeleton, including in the wrist (see the NGC summary ACR Appropriateness Criteria® acute hand and wrist trauma). In patients with persistent symptoms thought to be due to an occult wrist fracture, MRI can be used as an alternative to presumptive casting and repeat radiographs. MRI is also sensitive to stress fractures and stress injuries of the physes, for example, in gymnasts. In patients with known chronic scaphoid fractures, the presence of nonunion, malunion, osteonecrosis, post-traumatic osteoarthritis, or a combination of those conditions will typically influence the patient's management. Somewhat surprisingly, MRI shows only moderate sensitivity and specificity for predicting osteonecrosis of the proximal pole of scaphoid fractures, and even some scaphoid fractures with MRI evidence of osteonecrosis may still heal with treatment. While the addition of intravenous contrast can improve the accuracy for osteonecrosis and predicting graft healing, the routine use of intravenous contrast for this indication is controversial: while nonenhancement of the proximal scaphoid pole is a reliable sign of osteonecrosis, enhancement can be seen in both viable and nonviable fracture fragments. MRI does seem to be more reliable for diagnosing osteonecrosis in other carpal bones like the lunate (Kienböck's disease), and is certainly more accurate than conventional radiographs.

Fluid-filled and synovial-lined structures (including ganglia, cysts, bursa, and tendon sheaths) are well depicted with MRI. MRI is useful for diagnosing infectious and noninfectious tenosynovitis in both the flexor and extensor wrist compartments. Occult ganglion cysts are also easily identified with MRI but some authors recommend use of intravenous contrast to distinguish ganglia from synovitis.

In patients with early rheumatoid arthritis (RA) and other inflammatory arthritides, active synovitis may be better quantified following intravenous contrast administration, especially if performed dynamically, allowing confident early diagnosis, prognostication, and treatment guidance in these patients. Additionally, inflammatory tenosynovitis may be more conspicuous after intravenous contrast administration. As is the case for any tomographic study, MRI is much more sensitive than radiographs for identifying erosions in RA, even with some small-bore, dedicated extremity scanners. More importantly, though, the finding of enhancing bone marrow "edema" (osteitis) on MRI studies in patients with early RA is proving to be the best single predictor of future disease progression and functional deterioration, even compared to serologies and clinical measures.

Carpal tunnel syndrome is usually diagnosed by clinical signs and symptoms, combined with the results of electrodiagnostic studies. The MRI findings that have been reported in wrists with carpal tunnel syndrome – including nerve enlargement, nerve flattening, and retinacular bowing – have limited usefulness in patients with clinically recognized carpal tunnel syndrome, and low predictive value in patients with nonspecific wrist pain. There is some evidence that the length of T2 hyperintensity in the median nerve can help prognosticate the success of surgery, and that the size of the nerve in the distal carpal tunnel is associated with clinical severity, but in general MRI is not indicated in the evaluation of uncomplicated carpal tunnel syndrome. MRI may be helpful when a mass lesion is suspected in the carpal tunnel or when symptoms recur after carpal tunnel release.

Computed Tomography

CT of the wrist is used primarily when high-detail imaging of bone cortex or trabeculae is needed. In patients with chronic wrist pain and prior fractures, CT is typically the study of choice to evaluate fracture healing and joint congruence. When a radiographically occult fracture is suspected as the cause of a patient's chronic pain, either CT or MRI can be used. Advantages of CT over MRI for the wrist include its ability to obtain high-resolution images of both wrists simultaneously, and the much shorter acquisition times for CT. These factors make CT the preferred examination for suspected distal radioulnar joint subluxation, where images of both wrists can be obtained in both supination and pronation. Disadvantages of CT include its use of ionizing radiation and its lower sensitivity to soft-tissue abnormalities, compared with MRI.

High-resolution (typically multidetector) CT of the wrist following contrast injection into one or more wrist compartments (CT arthrography) is a powerful tool for diagnosing intra-articular abnormalities. The intraobserver agreement on CT arthrogram images is extremely high and better than that reported for MRI. Compared with conventional arthrography, CT arthrography has similar sensitivity and specificity for identifying intrinsic ligament tears, although CT arthrography is better at depicting the site of the torn ligament(s). The accuracy of CT arthrography for intrinsic ligament tears is higher than that for noncontrast-enhanced MRI, at least for tears of the biomechanically important dorsal fibers. In addition, CT arthrography appears to be more accurate than either MRI and MR arthrography for identifying articular cartilage defects in the wrist, and similar to MR arthrography for the diagnosing of TFCC lesions.

Ultrasound (US)

Sonography of the wrist is useful for examining extra-articular soft tissues, such as suspected ganglion cysts, where its accuracy is similar to that of MRI, but its cost is lower. US can also be used to diagnose abnormalities of the flexor and extensor tendons and tendon sheaths. For de Quervain's disease (stenosing tenosynovitis of the abductor pollicis longus and extensor pollicis brevis tendon compartment), preoperative identification of a septum or subcompartmentalization within the first dorsal compartment with US may affect surgical management.

Sonographic measurements of the median nerve within and proximal to the carpal tunnel correlate with the diagnosis of carpal tunnel syndrome, but similar to the situation for MRI, the clinical and electrophysiologic diagnosis rarely needs US imaging confirmation. The size of the median nerve measured sonographically does correlate with the clinical and neurophysiologic severity of the disease. There is some evidence that the presence of vessels or hypervascularity within the carpal tunnel, demonstrated with power Doppler US, is another feature of carpal tunnel syndrome.

In patients with RA, sonography of the wrist and metacarpophalangeal joints has been used to show inflammation – a feature that predicts progression of erosions, and erosions themselves. However, US is similar to radiographs in sensitivity for erosions, and both are inferior to MRI. Furthermore, unlike MRI, US cannot show changes within the bone marrow, which are the strongest prognosticator for disease progression in RA.

While some investigators have tried high-resolution ultrasonography with or without arthrography for diagnosing intrinsic ligament or TFCC abnormalities, its reported sensitivity is relatively low compared with that of MRI, and imaging with US is largely limited to the dorsal fibers of the ligaments and TFCC. Wrist US is a useful technique to guide therapeutic intra-articular and other soft-tissue injections.

Arthroscopy

Arthroscopy is considered the gold standard for diagnosing internal derangements in the wrist — tears of the intrinsic ligaments, abnormalities of the TFCC, and articular cartilage defects — and many of these lesions can also be treated through the arthroscope, often precluding open surgery. Some ganglia can also be managed arthroscopically. In selected patients with RA, arthroscopic synovectomy may be a useful adjunct to medical therapy or an alternative to more complex, open procedures. Arthroscopy is both more invasive and more expensive than radiologic imaging techniques.

Summary and Recommendations

- Radiographs should be the initial imaging study in any patient with chronic wrist pain.
- Ulnar-sided wrist pain is often related to ulnocarpal impaction, TFCC lesions, and/or lunotriquetral ligament tears. While diagnosis with conventional arthrography is accurate for these conditions, a positive arthrogram cannot provide the detailed anatomic information needed for treatment planning, and a negative arthrogram cannot identify extra-articular causes of ulnar-sided pain. High-resolution MRI, using an appropriate local coil, is an effective examination in these patients, but it has relatively low sensitivity for lesions of the distal and ulnar attachments of the TFCC. Performing indirect MR arthrography does not improve diagnosis, but direct MR arthrography does. When direct MR arthrography is not available, performing MRI with a high-field-strength (3.0-T) system is probably preferable to doing a study on a lower-field-strength system. CT arthrography is at least as accurate as MR arthrography in patients with ulnar-sided pain and is a good alternative. US currently does not provide a complete, accurate examination of the ulnar side of the wrist compared with these other modalities.
- In patients with radial-sided wrist pain, isolated ligament perforations do not always correspond with pain or instability, making conventional arthrography a poor choice of modality. MRI is the preferred examination in these patients because of its ability to diagnose bone, tendon, tendon sheath, and synovial abnormalities in addition to scapholunate ligament tears. Performing indirect MR arthrography may increase the accuracy for diagnosis of scapholunate ligament tears; direct MR arthrography is definitely more accurate than noncontrast-enhanced MRI for these tears. If there is a strong clinical suspicion that an occult ganglion cyst or de Quervain's disease is the cause of radial-sided wrist pain, US may be a better choice than MRI as a screening imaging test, in part because of the lower cost of sonography.
- Most bone lesions responsible for chronic wrist pain will be evident on radiographs. For diagnosing radiographically occult fractures and complications of fractures (such as nonunion and osteonecrosis), both MRI and CT have a role in specific circumstances; specifically, for detecting complications after scaphoid fracture, either MRI or CT can be performed. MRI is probably the study of choice in patients without fractures who have suspected osteonecrosis. While scintigraphy is sensitive to bone abnormalities, it has a limited role in the evaluation of chronic wrist pain because of its low specificity.
- Conventional MRI and indirect MR arthrography demonstrate only fair sensitivity for articular cartilage lesions in the wrist. Direct MR arthrography and CT arthrography are more accurate, but arthroscopy may be necessary for patients with a high clinical suspicion of a chondral defect. Intra-articular lesions of the ligaments, TFCC, and articular cartilage may also be amenable to arthroscopic treatment.
- While both MRI and US findings correlate with the diagnosis and severity of carpal tunnel syndrome, they are rarely necessary in patients with a certain clinical and/or electrophysiologic diagnosis. MRI probably has value in rare cases where a mass is thought to be responsible for median nerve dysfunction or in patients who experience recurrent symptoms following carpal tunnel release.

- The role of wrist imaging in patients with RA is expanding. MRI is much more sensitive than radiographs or US for identifying erosions. Intravenous-contrast-enhanced MRI accurately depicts active synovitis and tenosynovitis, which may allow confident diagnosis of RA earlier than diagnosis relying on clinical signs and symptoms, and which correlate with disease activity. Most importantly, osteitis (enhancing marrow "edema") is a finding only demonstrable on MRI studies, and is proving to be the most important predictor of disease progression.
- Imaging a patient with a suspected wrist mass can be accomplished in several equally appropriate ways. If a ganglion or other cyst is most likely, US is probably the most cost-effective initial examination, recognizing that a second study (typically MRI) may be needed if the initial US is normal or shows a non-specific solid mass. MRI examination can be performed without contrast if a radiologist will be available to check the initial images and give contrast if the noncontrast images are inconclusive. Alternatively, if an MRI examination will be performed without active monitoring by a radiologist, the study may be done with intravenous contrast administration.

Anticipated Exceptions

Nephrogenic systemic fibrosis (NSF) is a disorder with a scleroderma-like presentation and a spectrum of manifestations that can range from limited clinical sequelae to fatality. It appears to be related to both underlying severe renal dysfunction and the administration of gadolinium-based contrast agents. It has occurred primarily in patients on dialysis, rarely in patients with very limited glomerular filtration rate (GFR) (i.e., <30 mL/min/1.73 m^2), and almost never in other patients. There is growing literature regarding NSF. Although some controversy and lack of clarity remain, there is a consensus that it is advisable to avoid all gadolinium-based contrast agents in dialysis-dependent patients unless the possible benefits clearly outweigh the risk, and to limit the type and amount in patients with estimated GFR rates <30 mL/min/1.73 m^2. For more information, see the ACR Manual on Contrast Media (see the "Availability of Companion Documents" field).

Abbreviations

- CT, computed tomography
- MR, magnetic resonance
- MRI, magnetic resonance imaging
- Tc, technetium
- US, ultrasound

Relative Radiation Level Designations

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
O	0 mSv	0 mSv
☢	<0.1 mSv	<0.03 mSv
☢☢	0.1-1 mSv	0.03-0.3 mSv
☢☢☢	1-10 mSv	0.3-3 mSv
☢☢☢☢	10-30 mSv	3-10 mSv
☢☢☢☢☢	30-100 mSv	10-30 mSv
*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (e.g., region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "Varies."		

Clinical Algorithm(s)

Algorithms were not developed from criteria guidelines.

Scope

Disease/Condition(s)

Chronic wrist pain

Guideline Category

Diagnosis

Evaluation

Clinical Specialty

Family Practice

Internal Medicine

Nuclear Medicine

Orthopedic Surgery

Radiology

Rheumatology

Intended Users

Health Plans

Hospitals

Managed Care Organizations

Physicians

Utilization Management

Guideline Objective(s)

To evaluate the appropriateness of initial radiologic examinations for patients with chronic wrist pain

Target Population

Patients with chronic wrist pain

Interventions and Practices Considered

1. X-ray wrist
2. Magnetic resonance imaging (MRI) wrist
    - Without contrast
    - Without and with contrast
3. X-ray arthrography wrist
4. Ultrasound (US) wrist
5. Computed tomography (CT) wrist
    - Without contrast
    - With contrast
    - Without and with contrast
6. CT arthrography wrist
7. MR arthrography wrist
8. Technetium (Tc)-99m bone scan wrist

9. Aspiration wrist

Major Outcomes Considered

Utility of radiologic examinations in differential diagnosis

Methodology

Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Literature Search Procedure

The Medline literature search is based on keywords provided by the topic author. The two general classes of keywords are those related to the condition (e.g., ankle pain, fever) and those that describe the diagnostic or therapeutic intervention of interest (e.g., mammography, MRI).

The search terms and parameters are manipulated to produce the most relevant, current evidence to address the American College of Radiology Appropriateness Criteria (ACR AC) topic being reviewed or developed. Combining the clinical conditions and diagnostic modalities or therapeutic procedures narrows the search to be relevant to the topic. Exploding the term "diagnostic imaging" captures relevant results for diagnostic topics.

The following criteria/limits are used in the searches.

1. Articles that have abstracts available and are concerned with humans.
2. Restrict the search to the year prior to the last topic update or in some cases the author of the topic may specify which year range to use in the search. For new topics, the year range is restricted to the last 5 years unless the topic author provides other instructions.
3. May restrict the search to Adults only or Pediatrics only.
4. Articles consisting of only summaries or case reports are often excluded from final results.

The search strategy may be revised to improve the output as needed.

Number of Source Documents

The total number of source documents identified as the result of the literature search is not known.

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Strength of Evidence Key

Category 1 - The conclusions of the study are valid and strongly supported by study design, analysis, and results.

Category 2 - The conclusions of the study are likely valid, but study design does not permit certainty.

Category 3 - The conclusions of the study may be valid but the evidence supporting the conclusions is inconclusive or equivocal.

Category 4 - The conclusions of the study may not be valid because the evidence may not be reliable given the study design or analysis.

Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

The topic author drafts or revises the narrative text summarizing the evidence found in the literature. American College of Radiology (ACR) staff draft an evidence table based on the analysis of the selected literature. These tables rate the strength of the evidence for all articles included in the narrative text.

The expert panel reviews the narrative text, evidence table, and the supporting literature for each of the topic-variant combinations and assigns an appropriateness rating for each procedure listed in the table. Each individual panel member forms his/her own opinion based on his/her interpretation of the available evidence.

More information about the evidence table development process can be found in the ACR Appropriateness Criteria® Evidence Table Development document (see the "Availability of Companion Documents" field).

Methods Used to Formulate the Recommendations

Expert Consensus (Delphi)

Description of Methods Used to Formulate the Recommendations

Modified Delphi Technique

The appropriateness ratings for each of the procedures included in the Appropriateness Criteria topics are determined using a modified Delphi methodology. A series of surveys are conducted to elicit each panelist's expert interpretation of the evidence, based on the available data, regarding the appropriateness of an imaging or therapeutic procedure for a specific clinical scenario. American College of Radiology (ACR) staff distributes surveys to the panelists along with the evidence table and narrative. Each panelist interprets the available evidence and rates each procedure. The surveys are completed by panelists without consulting other panelists. The ratings are a scale between 1 and 9, which is further divided into three categories: 1, 2, or 3 is defined as "usually not appropriate"; 4, 5, or 6 is defined as "may be appropriate"; and 7, 8, or 9 is defined as "usually appropriate." Each panel member assigns one rating for each procedure per survey round. The surveys are collected and the results are tabulated, de-identified and redistributed after each round. A maximum of three rounds are conducted. The modified Delphi technique enables each panelist to express individual interpretations of the evidence and his or her expert opinion without excessive bias from fellow panelists in a simple, standardized and economical process.

Consensus among the panel members must be achieved to determine the final rating for each procedure. Consensus is defined as eighty percent (80%) agreement within a rating category. The final rating is determined by the median of all the ratings once consensus has been reached. Up to three rating rounds are conducted to achieve consensus.

If consensus is not reached, the panel is convened by conference call. The strengths and weaknesses of each imaging procedure that has not reached consensus are discussed and a final rating is proposed. If the panelists on the call agree, the rating is accepted as the panel's consensus. The document is circulated to all the panelists to make the final determination. If consensus cannot be reached on the call or when the document is circulated, "No consensus" appears in the rating column and the reasons for this decision are added to the comment sections.

Rating Scheme for the Strength of the Recommendations

Not applicable

Cost Analysis

The guideline developers reviewed published cost analyses.

Method of Guideline Validation

Internal Peer Review

Description of Method of Guideline Validation

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The recommendations are based on analysis of the current literature and expert panel consensus.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Selection of appropriate radiologic imaging procedures for evaluation of patients with chronic wrist pain

Potential Harms

- Direct magnetic resonance (MR) has higher sensitivity for intrinsic ligament lesions, although there may be more false-positive diagnoses as occasionally contrast will communicate between the radiocarpal and midcarpal compartments in wrists where ligament tears are not visible at MR arthrography or arthroscopy, presumably due to pinpoint-size lesions.
- Disadvantages of computed tomography (CT) include its use of ionizing radiation and its lower sensitivity to soft-tissue abnormalities, compared with magnetic resonance imaging (MRI).

Gadolinium-based Contrast Agents

Nephrogenic systemic fibrosis (NSF) is a disorder with a scleroderma-like presentation and a spectrum of manifestations that can range from limited clinical sequelae to fatality. It appears to be related to both underlying severe renal dysfunction and the administration of gadolinium-based contrast agents. It has occurred primarily in patients on dialysis, rarely in patients with very limited glomerular filtration rate (GFR) (i.e., <30 mL/min/1.73 m^2), and almost never in other patients. Although some controversy and lack of clarity remain, there is a consensus that it is advisable to avoid all gadolinium-based contrast agents in dialysis-dependent patients unless the possible benefits clearly outweigh the risk, and to limit the type and amount in patients with estimated GFR rates <30 mL/min/1.73 m^2. For more information, see the American College of Radiology (ACR) Manual on Contrast Media (see the "Availability of Companion Documents" field).

Relative Radiation Level (RRL)

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, both because of organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared to those specified for adults. Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® Radiation Dose Assessment Introduction document (see the "Availability of Companion Documents" field).

Qualifying Statements

Qualifying Statements

The American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Living with Illness

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

Rubin DA, Weissman BN, Appel M, Arnold E, Bencardino JT, Fries IB, Hayes CW, Hochman MG, Jacobson JA, Luchs JS, Math KR, Murphey MD, Newman JS, Scharf SC, Small KM, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness CriteriaÂ® chronic wrist pain. [online publication]. Reston (VA): American College of Radiology (ACR); 2012. 13 p. [92 references]

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

1998 (revised 2012)

Guideline Developer(s)

American College of Radiology - Medical Specialty Society

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Guideline Committee

Committee on Appropriateness Criteria, Expert Panel on Musculoskeletal Imaging

Composition of Group That Authored the Guideline

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Financial Disclosures/Conflicts of Interest

Not stated

Guideline Status

This is the current release of the guideline.

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Guideline Availability

Electronic copies: Available from the American College of Radiology (ACR) Web site.

Print copies: Available from the American College of Radiology, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

Availability of Companion Documents

The following are available:

- ACR Appropriateness Criteria®. Overview. Reston (VA): American College of Radiology; 2 p. Electronic copies: Available in Portable Document Format (PDF) from the American College of Radiology (ACR) Web site.
- ACR Appropriateness Criteria®. Literature search process. Reston (VA): American College of Radiology; 1 p. Electronic copies: Available in PDF from the ACR Web site.
- ACR Appropriateness Criteria®. Evidence table development – diagnostic studies. Reston (VA): American College of Radiology; 2013

Nov. 3 p. Electronic copies: Available in PDF from the ACR Web site .

- ACR Appropriateness Criteria®. Radiation dose assessment introduction. Reston (VA): American College of Radiology; 2 p. Electronic copies: Available in PDF from the ACR Web site .
- ACR Appropriateness Criteria®. Manual on contrast media. Reston (VA): American College of Radiology; 90 p. Electronic copies: Available in PDF from the ACR Web site .
- ACR Appropriateness Criteria®. Procedure information. Reston (VA): American College of Radiology; 1 p. Electronic copies: Available in PDF from the ACR Web site .
- ACR Appropriateness Criteria® chronic wrist pain. Evidence table. Reston (VA): American College of Radiology; 2012. 32 p. Electronic copies: Available from the ACR Web site .

Patient Resources

None available

NGC Status

This summary was completed by ECRI on May 6, 2001. The information was verified by the guideline developer as of June 29, 2001. This NGC summary was updated by ECRI on November 11, 2004. The information was verified by the guideline developer on December 21, 2004. This NGC summary was updated by ECRI on January 5, 2006. The updated information was verified by the guideline developer on January 19, 2006. This NGC summary was updated by ECRI Institute on May 19, 2010. This summary was updated by ECRI Institute on January 13, 2011 following the U.S. Food and Drug Administration (FDA) advisory on gadolinium-based contrast agents. This summary was updated by ECRI Institute on April 17, 2013.

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